AGRICULTURAL RESEARCH IN THE UNITED STATES

Summary of remarks by
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Agricultural research as we know it in the United States has had a brief but surprisingly successful history. This week the New Jersey Agricultural Experiment Station is celebrating its 75th anniversary. Similar ones are in operation in each of the 48 States, Alaska, Hawaii, and Puerto Rico. They are responsible only to their State authorities, yet they are closely associated with the scientific research of the Federal Department of Agriculture. The State stations are responsible for scientific operations at about 500 centers, including both the main stations and outlying laboratories and farms. When added to the research centers operated by the Federal Department of Agriculture, the total approximates 600. This publicly sponsored establishment, linked closely through State and Federal legislation and even more closely through the kinship of related disciplines, has contributed vastly to the technological progress of American farming and to the welfare of mankind.

Scope of Agricultural Research

The need for such a widespread activity is inherent in our geography. In the area known as the United States, including Alaska, Hawaii, Puerto Rico, and the Virgin Islands, we have a minimum of 514 different type-of-farming areas. We know of at least 5,500 soil series and the number is increasing with new surveys and classifications. There are five distinct climatic belts between the Atlantic and Pacific. To the north and south the climate ranges from the arctic to the subtropic. Tremendous differences exist in native vegetation and in the diversity of agricultural crops. Distances between producing areas and population centers bring numerous marketing and distribution problems. These many different physical conditions and the consequent wide variations in agriculture from one part of the nation to another are one basis for the dual structure of our publicly financed research. The other is the political organization of the United States. Through wide dispersal of research centers of the Federal and State establishments, science is brought close to farmers.

Because of this proximity, needs of farmers, marketing agencies and consumers are readily determined. This has been particularly valuable in meeting the diversified problems that arise because of the great variations in farming patterns in the United States. For example, corn and hog production is centered in the Middle West. Wheat production is concentrated in the Great Plains States and in the Pacific Northwest. Cotton is grown in the South. Citrus fruits are produced mostly in California, Texas, and Florida. Beef cattle production is centered in the Great Plains and Prairie belt States. The broad diversity of our agriculture explains the need for the cooperative research effort between the Department and the States, which extends to every problem area of the country.

The results of this cooperative problem-directed approach speak for themselves. Visitors from many countries find the productivity of the American farmer amazing. According to the latest figures, one farm worker in this country can produce enough food and fiber to take care of himself and the needs of 18 other persons. Today our farmers are producing 38 percent more products on the same amount of land they farmed in the late 1930's. They are doing it with fewer workers. For example, acre yields of corn have gone up 52 percent; for wheat 30 percent; for cotton 31 percent.

Examples of How Research Contributes

I want to give briefly a few examples of how these things are accomplished. One of them is in an important field of research now under way cooperatively by the Department and 40 State Experiment Stations. We call it the beef cattle breeding program. To date this research has given proof that the ability of beef cattle to make rapid gains in the feedlot is highly heritable. This means that bulls selected for higher rate of gain pass this characteristic on to their offspring. The Texas Experiment Station has just published a bulletin reporting on performance tests involving more than 700 steers. In these experiments the

high-gaining 30 percent of the steers made 36 percent greater gain than the low-gaining 30 percent. Scientists estimate that the output of beef can be increased by at least 10 percent in the next 15 years by this method. When we add to the results of the experiments all the knowledge that is being gained through cattle feeding tests, developments in antibiotic and other additives, and many other lines of cattle research, we can envision the progress we are likely to make in the years ahead in beef production alone.

Another example is that of the accomplishments we have made in the production of corn. In 1917 a plant geneticist at one of our agricultural experiment stations developed the double-cross technique in hybrid corn breeding. The results were so amazing that a few years later corn breeders at 12 experiment stations and in the Department of Agriculture decided to combine their efforts so that each could benefit by work done by the others. This cooperation has expanded over the years so that now, through exchange of information and breeding material, each region has built its own inbred lines to create hybrids adapted to its area.

Farmers started planting the seed as soon as it was ready. Most of the corn planted today in the United States is hybrid, and it is also being developed in other countries. Hybrid corn on the average yields about 30 percent more than ordinary corn. Thus in the United States, hybrid corn is adding $1,000,000,000 a year to farm income. Larger corn crops are being produced today than in 1939, and fewer acres are being used for the crop.

Nevertheless, research on hybrid corn is not ended. Present work is directed toward developing resistance to destructive insects and diseases and reducing the labor of corn breeding. For example, by developing male-sterile plants that produce no pollen, growers could produce hybrid seed without the big job of detasseling.

Breeders are also learning how to manipulate the chemical composition of

the grain so as to tailor the corn to the industrial market. They are providing corn with high starch and oil content and increasing the protein content, particularly zein.

Then there is the way in which the cooperative efforts of the State Experiment Stations and the Department solved the baffling problem of X-disease, a frequently fatal skin disease of cattle. The cause was found to be a chemical ingredient in certain greases used widely on the farm. Industry cooperated by eliminating the offending chemical. Last year one of the large livestock States reported that X-disease had been eliminated from within its borders. And so there is hardly a field where cooperation of the State stations and the Department has not been able to make tremendous contributions to the technology of American farming.

Public and Private Research

Although the term agricultural research in the organizational sense means research carried on by the Department of Agriculture and the State Experiment Stations, much of it is also undertaken by numerous food- and farm-related industries, by farmer organizations, by private foundations, and by other Federal and State establishments.

Basic Problems in Administration

To adequately meet the needs of the extensive research needed in the Federal- and State-financed establishments raises some underlying questions. These include: (1) How to meet the most urgent problems in the various geographic areas in the different political divisions of the country; (2) How to group the many different types of research undertakings to get results without waste of effort and duplication; (3) How to establish close liaison and cooperative working relationships among the various institutions and individuals engaged in agricultural research; (4) How to finance the required research and obtain competent and adequately trained scientific personnel; (5) How to provide

adequate dissemination (a) of the scientific information needed by the scientists engaged in research and (b) of the results growing out of the research among farmers and the general public for whose benefit the research is undertaken.

To understand how these problems are handled, it should be pointed out that State Experiment Stations' research is primarily concerned with the solution of problems of importance to the welfare of farmers and the people within the States. Solutions of problems that are national in scope are carried on by the Federal Government, very often in close cooperation with individual States or the experiment stations of several States. Regional problems usually are the subject of cooperation between the stations of the region and the Department of Agriculture. Under the regional program we now have 148 technical advisory committees, made up of specialists from participating State Experiment Stations and branches of the Federal Department of Agriculture.

History and Development of Cooperation

It is also necessary to understand something about the history and development of the land-grant colleges and the Department of Agriculture and the basic services they are called upon to give to agriculture.

In 1862 the Federal Congress created what is now the United States Department of Agriculture. The new Federal agency was directed to "acquire and diffuse useful information on subjects connected with agriculture in the most general and comprehensive sense of the word." That same year Congress also passed the Land-Grant College Act, "donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts." In 1887 the Federal Congress passed the Hatch Experiment Station Act. This became the foundation stone for the close cooperation and working relationship between State and Federal agricultural research.

While there is considerable variation in the organization of the separate land-grant colleges and universities, all of them include three major services

to agriculture. One of these is classroom education, providing both undergraduate and graduate studies in science for preparing personnel to engage in farming, research, and other technical occupations. The second is research. While this is done in various departments of subject matter, such as soils, agronomy, and many others, the agricultural research is carried on under a single administrator, the State Experiment Station Director. The third basic service is cooperative extension work.

How Problems Come to Attention of Research

When farmers are confronted by serious production problems, they usually make their needs known to their county agricultural agents who are employees of the Federal-State cooperative extension service. The Extension Service relies on its Experiment Station and the Department of Agriculture to put their scientific resources to work. Most of the stations have advisory committees and boards that bring problems to the station directors. Close cooperators with the land-grant colleges and the Department also are the general farm organizations and numerous farmer production groups. On the national basis we now have 32 advisory committees and an overall agricultural research policy committee.

Departmental Administration

The publications on the table include a question and answer leaflet describing the departmental organization and administration of research.

The Department conducts comprehensive research in farm management, soil and water conservation and management, crop and livestock production, entomology, plant and animal diseases, forestry, agricultural engineering, agricultural economics, processing and utilization of agricultural products, marketing, including both domestic and foreign markets, cooperative organizations, human nutrition and home economics. While responsibility for research

administration is vested in several agencies, the total program of the Department is so organized that coordinating responsibility is vested in the office of the Agricultural Research Administrator.

In the fields mentioned we have extensive cooperation with the State Experiment Stations, and one of the Department's responsibilities is to administer Federal-grant funds made available to the States by the Congress. In marketing research we also have a great deal of cooperation with marketing agencies and State Departments of Agriculture. The Department conducts about 85 percent of the Nation's research in forest production and marketing. Forest research, in addition to being carried on at a national Forest Products Laboratory and 63 decentralized research centers and more than 100 experimental forests and ranges, also involves cooperation with many private agencies and State Schools of Forestry.

Staffing and Financing

The total scientific personnel employed in the United States as of the present includes about 4, 800 departmental and about 7, 900 State Experiment Station workers. The latter includes people who engage part time in research and part time in teaching and extension work at the land-grant institutions. Also a large number of persons are engaged in private agricultural research. Included are those scientists employed by farmer groups, industry, and commercial interests and those supported by some 55 foundations organized on a nonprofit basis to aid agricultural research.

In the current fiscal year the amount of Department of Agriculture funds available for agricultural research totals $80, 147, 000, including $24, 250, 000 of Federal-grant funds to State Agricultural Experiment Stations. These stations also receive $78, 000, 000 in State funds. The amount of private research is estimated at $150, 000, 000. Thus we have available for all agricultural research in the fiscal year 1955-56 over $300, 000, 000.

Dissemination of Research Results

Results from agricultural research are made known in a number of ways. The institutions carrying on research issue both technical and popular bulletins and reports. During the past fiscal year the Department of Agriculture issued 18 farmers' bulletins, 25 leaflets, 8 home and garden bulletins, and 381 other publications. These were new publications making the results of agricultural research available to the public.

During the 1953-54 fiscal year, the agricultural experiment stations issued 398 popular and 391 technical bulletins and reports. They also issued 398 pamphlets and 1, 841 mimeographed or otherwise processed publications. During that year State Experiment Station workers published a total of 4, 798 scientific papers in the technical journals and 704 in popular journals. In the past fiscal year (July 1954 through June 1955) research workers in the Agricultural Research Service prepared and submitted 1, 940 manuscripts to technical and scientific journals.

While publications in the official and technical press constitute the firm core of basic information, dissemination of new results is far more widespread through the mass media like farm magazines, newspapers, radio, television through the schools and colleges and through the cooperative extension service. The close association between research and extension work, both in the Department of Agriculture and at the land-grant institution, is a factor that has played an important part in motivating farm people to adopt new farm practices developed through agricultural research.

In summary, agricultural research in the United States represents a great, cooperative undertaking, in which the States, the Federal Government, and private industry and intellectual circles are associated for a common purpose--to unearth new knowledge of benefit to agriculture and the public. Since the beginning this cooperative enterprise has been publicly financed to a considerable

extent. Out of it have grown many advances such as mechanized agriculture, modern food processing, the discovery of vitamins, modern animal nutrition, numerous lifesaving antibiotics, to mention but a few. Since its earliest days our agricultural research has had the close practical cooperation of farmers, industry, and private business. There has also been a close kinship between science and education. Our agriculture has benefitted greatly from contributions made by men of science from all nations. Also, we have drawn heavily on introduced plants and animals from foreign lands which have supplied valuable germ plasm in improving our crops and animals. We hope that what we are doing will benefit people all over the world. We are convinced that science has played a great part in the agricultural development of this country.

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